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The MONTHLY REVIEW

Published Monthly by the

American Electroplaters Society

A SOCIETY FOR THE ADVANCEMENT

OF THE

SCIENCE OF ELECTROPLATING

OCTOBER, 1925

Entered as second-class matter, September 26, 1922, at the Post Office at Oneida, N. Y., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of October 3, 1917, authorized September 26, 1922.

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ANNUAL BANQUET

PHILADELPHIA BRANCH

Saturday, Nov. 21, 1925

Mosebach's Cafe, 13th Street and Girard Avenue PHILADELPHIA, PA.

Afternoon Session - - - - 3:45 P. M.
Dinner - - - - - - 6:15 P. M.

TICKETS $3.00 PER PLATE

The Committee

MONTHLY REVIEW

Published by the

American Electroplaters' Society

ONEIDA, NEW YORK

Editor's Office, 166 Willow Place, Sherrill, New York

VOL. XII OCTOBER, 1925 No. 10

EDITORIAL

HAVE YOU DONE YOUR SHARE?

Our membership drive has been in progress for the past 30 days and as all organizations are composed of two classes of members, the ones that DO their share of work, and those who INTEND to do it, it is only natural that our Society contains some of the "good-intention" members.

Of course, I did not expect reports for the first half of the drive to show that half of the desired new applications had been received, but I certainly expect and sincerly trust that during the last half that our members will exert their every effort in order to acquire the quota of new members that was assigned to their respective branch.

The road to hell is paved with good intentions, while the road to success is paved with good deeds. The best deed that you can do for a non-member of the A. E. S. is to get his application for our Society at once.

If you have not already done your share, WILL YOU?

Yours very truly,

E. J. MUSICK,
Supreme President.

ANNOUNCEMENT

The next annual event on the part of Chicago Branch, American Electroplaters' Society will be held on Saturday afternoon and evening, January 23, 1926. This affair will be held on the basis of an educational session on Saturday afternoon, January 23, with the banquet and dinner-dance following immediately after the close of the educational session in the afternoon. Further and more complete details to follow later.

THE APPLICATION OF CHROMIUM PLATING TO PRINTING PLATES[1]

H. E. Haring[2]

[1]Published by permission of the Director, Bureau of Standards, Department of Commerce, Washington, D. C.

[2]Associate Chemist, Bureau of Standards.

I—INTRODUCTION[3]

[3]The essential facts regarding this process were presented at the meeting of the American Electroplaters' Society on June 30, 1925. A more detailed article by H. E. Haring on this subject was published in Chemical and Metallurgical Engineering for August, 1925.

Several years ago the Bureau of Standards, in co-operation with the Bureau of Engraving and Printing developed an electrolytic process for the reproduction of engraved or "intaglio" plates, such as are used for printing currency and securities. The plates produced by this process, which has been in successful use since that time, have a nickel printing surface, backed up by successive layers of copper and nickel.

In plate printing the metal surface is rubbed with coarse cloth before each impression to remove the ink from the plane surface and to leave ink only in the engraved lines. This process involves severe abrasion, and hence the nickel plates do not last as long as the case-hardened steel plates, which had been formerly used exclusively. In order to increase the hardness of the surface of the electrolytic plates, the application of chromium plating was considered, because chromium is the hardest metal known.

A process was developed by which about 0.0002″ of chromium is deposited upon the nickel surface of an otherwise finished electrolytic plate. The results with about 1,000 such plates show that the impressions are even better than from the originals, and that they will yield several times as many impressions as the nickel-faced or the case-hardened steel plates. It is also possible to deposit the chromium on steel plates which have not been case-hardened and to secure from them greater service than from case-hardened plates. It is too early to estimate the average probable life of the chromium-faced plates, but from present indications their use will ultimately result in an annual saving of thousands of dollars to the Bureau of Engraving and Printing.

These results indicate the possible value of chromium plating for other purposes, especially where extreme hardness is required. In some cases it may replace the more troublesome and more expensive case-hardening process. Other properties of chromium plating which may prove useful are its high luster and reflecting power and its resistance to tarnish and oxidation, and also toward certain chemical reagents.

The investigation of chromium plating at the Bureau of Standards is still in progress. This paper will therefore be confined to certain general principles, and to the actual method used on printing plates. Some modifications of these conditions may be required for other specific purposes.

II—GENERAL PRINCIPLES

Almost all the solutions for chromium plating suggested in recent years have as their principal constituent chromic acid, CrO_3, together with a small amount of chromium sulphate, $Cr_2(SO_4)_3$, either added as such, or formed in the solution by some means. Experience with solutions containing only these two substances indicates that erratic results are often obtained. The study conducted at the Bureau has led to the conclusion that in order to produce satisfactory deposits of chromium it is necessary to maintain the degree of acidity or hydrogen ion concentration within definite limits. It has not been found possible by existing methods to measure the acidity (pH) of these strong solutions of chromic acid. It is possible, however, to regulate the acidity and keep it within the desired limits by having present in suspension some substance which will be readily formed or dissolved if the acidity changes, i. e., will exert a buffer action.

Such a substance is "chromium chromate," a compound of chromic acid and chromium in the next lower state of oxidation. The chromium chromate may be added as such to the bath, or may be formed in the bath by the addition of any suitable basic or reducing substance, or by the use of chromium anodes, or of lead anodes under proper conditions. It is almost certain that every chromic acid bath thus far proposed contained some of this suspended colloidal chromium chromate when satisfactory deposits were

produced, even though no steps had been taken to form it intentionally.

In the actual process at the Bureau of Engraving and Printing, chromium carbonate is added to the solution. This dissolves with effervescence, and forms chromium chromate, the presence of which is indicated by a nearly opaque reddish brown color in place of the ordinary deep orange of chromic acid.

With a given solution and acidity the cathode efficiency and the character of the deposit depend upon the temperature and current density. Three distinct types of chromium deposit may be produced. At a given current density, by increasing the temperature, we obtain (1) a dull, frosty or "burnt" deposit, which may range in color from nearly black to light gray; (2) a brilliant, smooth deposit of as high a luster as the base metal, even after hours of deposition, and (3) a smooth, but scant deposit, with a bluish, milky appearance. If the temperature is fixed and the current density increased, we obtain in order, the milky, the bright and the burnt deposit.

In Fig. 1, the curves show the relation between cathode efficiency and temperature for several current densities, and the dotted lines indicate the regions within which the three types of deposit are producel. Curve A is for 50 amp./ sq. ft., B is 100 amp./sq. ft., and C is 200 amp./sq. ft., on most metals including nickel-plated surfaces. Region 1 gives burnt deposits; 2, bright deposits, and 3, scant deposits. It was found, however, that in order to deposit satisfactorily

Fig 1.

Typical "Operating Curves" for Chromium Deposition:

Curve	Current Density
A	50 amp./sq. ft. (5.5 amp./dm²)
B[1]	100 amp./sq. ft. (11 amp./dm²)
C	200 amp./sq. ft. (22 amp./dm²)

Type of Deposit:

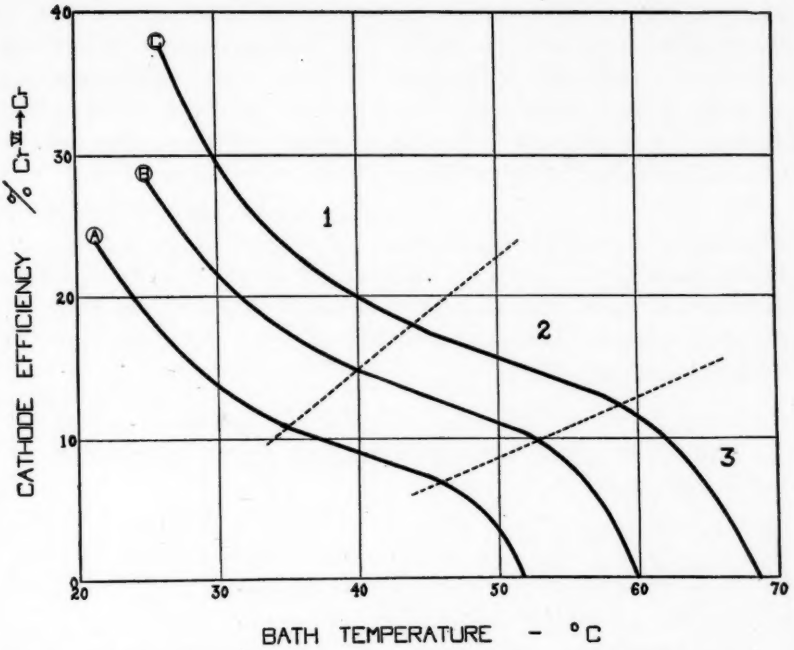
1 "Burnt" deposit

2 "Bright" deposit

3 Scant, bluish deposit

[1]Note: On electrolytic nickel printing plates, curve B represents 200 amp./sq. ft. (22 amp./dm²).

on the nickel face of an electrolytic plate, i. e., upon the



layer of nickel first deposited in the previous electroforming process, it requires a higher current density than on other surfaces, e. g., 200 amp./sq. ft., instead of 100 amp./sq. ft. It is probable that this difference is due to the effect of the very fine structure of the initial nickel layer. Curve B represents the conditions with 200 amp./sq. ft. upon such a nickel face, and also 100 amp./sq. ft. on other metal surfaces.

From the curves in Fig. 1, it is evident that the metal cathode efficiency is always low, and changes greatly with current density, as does also the character of the deposit. In consequence it is difficult to plate chromium on irregularly-shaped articles. In the recessed parts there is likely to be little or no deposit, while on exposed parts the deposit may be gray or burnt. The extreme hardness of chromium makes it difficult to produce, by buffing or polishing, a high luster on a dull chromium surface. Extensive application of chromium plating will therefore depend upon a marked improvement in throwing power.

In plating chromium, especially upon iron or nickel, it

is necessary to have the current on the cathode when it is introduced into the bath. If this is not done, the surface becomes "passive," and those parts which would normally receive a low current density will receive no deposit. Hence the apparent throwing power will be even worse than under the favorable conditions.

It is possible to strip chromium from steel or nickel by a reverse current in chromic acid, which does not attack these metals. To remove chromium from copper or brass it may be made the anode in dilute hydrochloric acid, or may be treated directly without a current with (1—3) hydrochloric acid.

III—OPERATING CONDITIONS

The solution used at the Bureau of Engraving and Printing is prepared from:

	g/L	oz/gal
Chromic acid CrO_3	250	33
Chromium sulphate $Cr_2(SO_4)_3$	3	0.4
Chromium carbonate $Cr_2O(CO_3)_2$	7	1.0

The exact concentrations are not, however, important. The composition may be controlled by chemical analysis, in which the chromium present in the three forms is indirectly determined.

The solution is contained in a stoneware jar, which is immersed in water in a larger tank. The anodes consist of sections of lead pipe with a total area equal to about one-half that of the cathode surface to be plated, and so placed as to produce a nearly uniform current density on the cathode. Behind the latter (which is plated on only one side), a coil of lead pipe is suspended, through which hot or cold water can be circulated to regulate the bath temperature. Very good ventilation is required, as a large amount of spray is formed, which is injurious to the nasal septum.

The plates are cleaned as cathodes in an alkaline cleaner, scrubbed with pumice, rinsed in warm water, rapidly dried, and placed in the bath in such a way as to complete the circuit. Drying is advantageous, but not absolutely necessary.

The bath is kept between 104 and 122°F (40° and

50°C), and preferably at 113°F (45°C). On steel plates the current density is 100 amp./sq. ft. (11 amp./dm²), which requires about 7 volts, and on electrolytic plates, 200 amp./sq. ft. (22 amp./dm²) using 9 volts. In both cases the metal cathode efficiency is about 12 per cent. In order to deposit about 0.0002″ (0.005 mm) of chromium, the steel is plated for sixty minutes and the electrolytic nickel for thirty minutes.

The author desires to express his sincere appreciation to William Blum of the Bureau of Standards for his active and helpful interest in this problem, and to T. F. Slattery and W. E. Bailey of the Bureau of Engraving and Printing for their invaluable aid in the adaption of the process to this special use.

PLATING ON ALUMINUM

By E. G. L.

The rapid growing importance of aluminum industry seems certain to result in a great increase in the use of this metal and the demand for plating these parts are large and the plater is called upon to satisfy this desire. Now, the plating of aluminum sheet or die cast is a simple matter as far as depositing the metal on the aluminum is concerned, and good adherent deposits can be procured. However, after a continual research of a period of the past year, we have, and when I say, we, I mean the firm that I am employed by, have come to the conclusion that at present the electroplating of aluminum parts is impracticable. This is a hard thing to have to acknowledge, but when a firm's reputation is at stake and they cannot guarantee their product to stand up under atmospheric corrosion, we find ourselves face to face with stern reality. Now, first let us go into the process generally used in plating aluminum.

The French process, which created so much interest, is to dip the aluminum parts in a chloride of iron solution, which deposits a thin film iron on the aluminum by simple immersion. Personally, I don't believe this film of iron plays a very important part in the success of the operation, as good deposits can be procured without it. It is merely due to the fact that the chemical action set up in the iron dip acts upon the surface of the aluminum and gives it what

I might call a fine etch. Now, if the film of iron were dissolved off in an acid dip and the aluminum plated with nickel, the deposit will adhere just as well without the iron as with it.

I have been using the following method and getting good results. When I say good results, I mean as far as the plating of aluminum is concerned. The aluminum is polished and cut down on a triple buff, then sent to the plating department and electro cleaned (We use a cleaner that is made specially for the Edmund & Jones Corp'n), they are then sent back to the buffing department and buffed to a high color. We again run them through the electro cleaner, rinse them in cold water and hang them in a hot, so-called combination plater and cleaner, which is copper cyanide, cyanide and caustic soda, using a strong current, say, 6 volts. We all know that aluminum will deposit copper from a cyanide solution by simple immersion, the same as the iron chloride solution does, the solution pressure being much higher in the aluminum or rather the aluminum is positive to the internal current. Now, we use an external current of 6 volts which deposits copper on the aluminum which helps to retard the violent action of the hydrates upon the aluminum. This coating of copper is not a good adherent deposit and would not stand buffing, but the combined action of current, hydrates, electro potentials, etc., has given us a chemical clean, semi-mat surface. We now remove the copper coating by immersing in a strong bright dip. This process was brought out by Mr. Norgren at the Cincinnati convention for plating nickel on nickel. The aluminum is now rinsed off in cold water with a small amount of acetic acid in the water and then struck in a nickel solution composed of 20 ozs. nickel sulphate, 3 grams acetic acid, 1 gallon of water used hot, about 110 F., 20 amperes per sq. foot. This solution gives a fine, close-grained deposit. They are given a 10-minute plate, then copper plated in an acid copper bath for 10 minutes and buffed; then in the regular single nickel bath at 25 amperes per sq. foot for 20 minutes. All our tanks are of the mechanical conveyor type with moving cathod. The copper plating can be eliminated and only nickel put on. The

plating of copper directly on aluminum is very bad practice, as I will try and show you as I go along.

I have some samples here of aluminum head-lamp doors.

No. 1 is plated with nickel only in the acetic acid nickel bath.

No. 2 is nickel plated then copper plated.

No. 3 is nickel plated, copper plated, then buffed, then nickel plated.

No. 4 is zinc plated.

Now, the general appearance of these doors are fairly good and for the amount of deposit, about .0008 inch on No. 3, it would appear the servicable wear would be excellent, but, sad to relate, such is not the case; it is merely an illusion. Might say, "It's beautiful but dumb." In Nos. 4 and 5 we have two of these doors that have been subject to atmospheric corrosion. If you examine them closely you will notice that the base metal, aluminum, has corroded and disintegrated, actually falling away. There is a strong galvanic action set up between aluminum and nickel, much stronger, I believe, than is generated between zinc and nickel. By putting copper next to the aluminum you increase the battery action. Deposited zinc on the aluminum retards the action some, as zinc plated aluminum stands up much better than on corrosion tests than nickel or copper plated aluminum. As aluminum stands so high in the electro chemical series the solution pressure is so great that such a strong galvanic action is set up that corrosion starts immediately and when the conditions are natural it is folly to expect the unnatural, therefore, I say, when the plater is called upon to nickel plate aluminum, he should have a thorough knowledge of the electro chemical condition that exists and not be too hasty in guaranteeing his results. I have here an aluminum door over which has been spun a brass covering, 25 gauge metal spun over the door tightly. To prove how strong this galcanic action is between the two metals in this case, brass and aluminum—I have cut away a portion of the brass casing and you will notice how badly the aluminum is corroded. Now, if this brass casing does not protect the aluminum from corrosion, what chase has a porous electro deposit?

I had the pleasure of a visit from Mr. E. Canning from the W. Canning Company of Buringham, England, and he told me of the problems they have encountered in England on plated aluminum. One firm there turned out a large amount of aluminum darning and crochet needles, nickel plated. After these had been put on the market the women started to use them, the persperation from their hands started the galvanic action and the plating would lift and cut their fingers. The firm had to discontinue the manufacture of them and go back to bone. Another firm put out a lot of aluminum, nickel-plated plumbers' hardware, and after a short time in service the same condition developed and their goods commenced to come back in large quantities; as Mr. Canning expressed it, tons of it were rejected at a tremendous loss to the manufacturer. The aluminum manufacturers of England have had any amount of formulas and methods submitted for nickel plating, but they have rejected all of them. So we, as platers, are up against a problem over which we seem to have no control; that is, it is easy enough to plate the metal, but the after affects are such that it is impractical to use nickel-plated aluminum on parts requiring serviceable wear, due to the strong galvanic action. We have had a number of papers on the successful method used in plating, but this is one of the unsuccessful methods. Are we going to leave this as one of the unsolved problems or is our research committee going to co-operate with the Bureau of Standards and give this subject some serious thought and give us some interesting data in the near future.

We are not bringing Mohamed to the mountain, we are bringing the mountain to Mohamed.

METALIZING ON NON-METALLIC OBJECTS

By E. Schor, New York Branch

The art of metallizing is a subject worth while to be taken up by the platers of today. Many articles could be manufactured by metallizing non-metallic objects by combining the Art of Electroplating with the Art of Sculpture, thereby making it possible to produce copies of the finest plastic art at a very low cost. When finished, these copies

have the appearance and wearing qualities of solid bronze.

In preparing non-metallic objects for metallizing it is necessary to divide them into two classes:

Class I—Those that are very porous, such as Plaster of Paris, Terra Cotta, Cork, Wood, etc.

Class II—Those that are less porous, such as Leather, Bone, Fruits, Flowers, Close-grain Wood, Glass and Porcelain.

The first operation in preparing objects of Class I is to make them thoroughly dry. After this is done they are introduced into an acid-proof composition. Unless this is done the solution will penetrate the object and spoil the entire operation.

To prevent this the objects are soaked in the following acid-proof composition:

Acid-Proof Composition

Carnauba (Brazilian) Wax..... 3 lbs.
Paraffine Wax ..... 7 lbs.

The melting point of the composition is about 235° F. The object must remain entirely covered for about 30 minutes. Then it should be taken out and allowed to dry. After the object is dry it is given a thin coat of shellac. Then it is set aside to dry. When thoroughly dried the object is sprayed with two coats of the following mixture:

Bronzing medium ..... 1-3 pt.
Bronzing medium thinner ..... 2-3 pt.
Copper plating bronze powder..... 2½ oz.

After this is done the object is allowed to dry between 4 and 5 hours in the air. After this time the object is ready for the copper-depositing bath.

Objects of Class II—In preparing the objects that are not very porous all that is necessary is to give them two coats of shellac, and after drying, spray the object with the same bronzing liquid formula as in class I. After the object is dried it is ready for the copper-depositing bath.

The Copper Solution

The nature of the copper solution is far more important than anyone would first suppose it to be. The ordinary acid copper solution used for plating is far too strong for metallizing purposes. The best solution I have used for this class of work is as follows:

Sulphate of Copper	24 ozs.
Sulphuric Acid	6 ozs.
Water	1 gal.

and 1 lb. of Oxalic Acid to every 100 gallons of solution.

The solution is kept in an agitated condition by means of air, as the agitation is very important. An agitated solution produces a more even deposit of copper and a better quality, preventing the forming of gas bubbles and streaks on the work which very often cause the plater a great deal of trouble, but which is seldom or never seen in an agitated bath; also a higher current may be used, resulting in an increased rate of deposition. When the work is put in the bath it is started on 2 volts and continued for about three hours. After this the work has to be taken out and looked over to see if there are any spots not covered. If there are any spots uncovered it has to be touched up with the paste of copper bronze powder and bronzing liquid. After that the voltage should be reduced to 1 volt and run at this rate from 24 to 36 hours. The amperage would have to be determined from the area of the cathode. About 18 amperes per square foot. After the given time the work is taken out, polished, buffed and finished in any desired finish.

ZINC CYANIDE VERSUS ZINC SULPHATE PLATING SOLUTION

By A. Pearson, Electrochemical Engineer,
Western Electric Company, Hawthorne, Ill.

During the past few years a considerable amount of attention has been given the subject of zinc plating with cyanide solutions. In general the results of these investigations show two advantages for this solution.

1. The deposit from the cyanide is more uniformly distributed over an irregularly shaped surface than it it is from sulphate solutions.
2. For equal thickness the deposits from the cyanide bath have the greater rust resisting qualities.

The experiments referred to above have all been conducted in the laboratories using small volume baths and small electrode surfaces and, therefore, present conditions

which are quite different than those met within the plant on large scale production. Although zinc cyanide solutions have been in commercial use for some time no investigation conducted under commercial conditions has been called to our attention. It was, therefore, deemed advisable to run a test in a commercial tank starting under the conditions which appeared in the laboratory to possess the greatest merits and make this run of such duration that equilibrium between the different variables would be established.

This paper is a description of the results obtained in the laboratory and shop tests comparing the merits of zinc cyanide solutions against those of zinc cyanide solutions against those of zinc sulphate such as is used in our Plating Department. Since a large amount of data was collected all unimportant details will be omitted. For convenience the subject will be divided in two parts: Laboratory Investigation and Shop Test.

Laboratory Investigation

Commercial chemicals and anodes were used in both the laboratory and shop tests. Forty-seven cyanide solutions varying in concentration of zinc cyanide, sodium cyanide, sodium hydroxide, and sodium carbonate or containing different brightening agents were tried. The brightening agents used were aluminum sulphate, sodium flouride, gum aarbic, corn sugar, lignol, and cyanobrite, all of which have been recommended by other investigators. Current effiicency and throwng power determonations were made at different temperatures and current densities on solutions which during the investigation appeared to have advantages.

From the data thus accumulated the most suitable solution composition and operating conditions were chosen and used as a starting point in the shop test. The following table gives the composition of the most suitable cyanide solution and that of our standard sulphate solution, the most desirable temperature, and current density, the current efficiency, throwing power, and comparative protective values of the deposits from the two types of solutions:

	Cyanide Solution	Sulphate Solution
Zinc Cyanide	7.75 oz./gal.	—
Sodium Cyanide	6.75 "	—
Sodium Hydroxide	1.30 "	—
Sodium Carbonate	None	—
Gum Arabic	.04 oz./gal.	—
Sodium Flouride	.97 "	—
Zinc Sulphate	—	56.0 oz./gal.
Sodium Chloride	—	3.0 "
Corn Sugar	—	1.0 "
Temperature	119°F.	85.5°F.
Current Density	15 Amp/sq. ft.	15 Amp./sq. ft.
Color	Gray	Light Gray
Throwing Power Plate 1.	55.4%	61.0%
" 2.	28.3%	20.7%
" 3.	26.3%	18.3%
Current Efficiency	94.1%	99.1%

Corrosion Test:

.25 oz. zinc per sq. ft.:		
Flat Plate	790 Immersions	559 Immersions
Single Angle Piece	430 "	27 "
Deeply Recessed Piece	210 "	10 "
.05 oz. zinc sq. ft.:		
Flat Plate	213 "	—
Single Angle Piece	71 "	—
Deeply Recessed Piece	25 "	— "

The figures given above represent the average of a number of samples run under the conditions specified.

The throwing power determinations were made according to the method used by Horsch and Fuwa (Massachusetts Institute of Technology—T. A. E. S., 1922, 211-231), in which one anode and three cathodes are placed in the same plane in such a way that the second cathode is directly behind the first and the third directly behind the second with reference to the anode. The cathodes surfaces were approximately nine sq. in. each and the anode surface about equal to the total cathode surface.

The corrosion test was made according to the method of Farnsworth and Hocker (T. A. E. S., Vol. XLV 281-296).

This method consists in immersing the parts in a two per cent ammonium chloride solution for a period of thirty seconds then allowing them to drain for fifteen minutes, repeating the operation until rust appears. This method of accelerated corrosion has been found to indicate non-uniformities and pin holes in the deposit more distinctly than the methods ordinarily used.

Shop Test

In this test it was desired to determine particularly:

1. The most satisfactory cyanide solution for large scale operation.
2. The maximum allowable current density of the two types of solutions.
3. The cathode current efficiency of the two solutions.
4. The distribution of deposits on the different parts of the racks.

Equipment:

A standard 350-gallon plating tank, having a horizontal cross-section of 11′x2½′ and being provided with three anode and two cathode rods placed longitudinally across the tank, was used. A single length of iron pipe was supported about 4″ above the bottom of the tank provided with steam connection and drain was used for heating the bath. A small centrifugal pump and a filter bag were used for circulation and filtration.

Duration of Test:

The cyanide tank was operated intermittently for a period of about three months, during which time 242 complete tank loads of work were plated in the cyanide solution. The sulphate solution was used under normal operating conditions during this period.

Solutions:

Our standard sulphate solution, the composition of which is given above, was used in this test. At the start a cyanide solution of the above composition was used.

Since zinc cyanide, sodium hydroxide, and sodium carbonate are constantly formed in the cyanide solution at the expense of sodium cyanide and the anodes, only sodium cyanide and brightening agents were added to the solution

to maintain it. It was found that the increase in zinc content in a cyanide solution is primarily due to the presence of free sodium cyanide. With this fact in mind the solution was allowed to decrease in free cyanide content and increase in zinc content as far as allowable consistent with satisfactory deposits. It was expected that in this way a solution composition might be reached where the increase in zinc content due to the chemical solubility of the anodes would be reduced to such a rate that the loss of solution carried out by the parts would compensate for it. A complete equilibrium was not obtained, but it was found that at the concentration used at the end of the test the increase in zinc content was very slow. The composition of the cyanide solution at the beginning and end of the test is given below:

	Start.	Finish
Zinc Cyanide	7.75 oz./gal.	11.90 oz./gal.
Sodium Cyanide	6.75 " "	3.50 " "
Sodium Hydroxide	1.30 " "	4.75 " "
Sodium Carbonate	None	1.93 " "
Sodium Flouride	.97	Not determined
Gum Arabic	.04	" "

No analyses were made for sodium flouride and gum arabic content. During the test the following additions were made to the cyanide solution:

Sodium Cyanide	.359 lbs. per load of parts plated
Sodium Flouride	.127 lbs. per load of parts plated
Gum Arabic	.025 lbs. per load of parts plated

Sodium Flouride and Gum Arabic were added when the color of the deposits indicated a necessity for brightening agents.

Effects of Concentration Changes:

The minimum allowable sodium cyanide concentration consistent with satisfactory deposits will depend on the current density used and to a less extent on the sodium hydroxide concentration. With a sodium cyanide content as low as 3.2 ounces per gallon and a sodium hydroxide concentration of 4.26 ounces per gallon satisfactory deposits were obtained at an average current density of 20 amperes per square foot. At higher current densities higher sodium

cyanide concentration was required in order to prevent spongy deposits at the points of highest current density. It was found that the color of the deposit could be much improved by reducing the current density to about five amperes per square foot during the last three or four minutes of the plating period.

(Continued Next Month)

BRANCH NEWS

Milwaukee Branch

The Milwaukee Branch on October 8 held one of the best attended meetings in several years. Practically all members located in or near Milwaukee attended.

Mr. Wittig reported on the conference of the Research Committee held at Chicago. He reported that the research work on plating by the Bureau of Standards would stop. The members agreed that this work should be continued.

The Milwaukee Branch will go back to the two meetings-a-month schedule, beginning in October. The second Thursday of each month will be the business meeting, the fourth Thursday the educational meeting. The following members have been appointed to act as a committee to map out an educational program and also bring in new members: R. Steuernagel, R. Goodsell, D. Wittig, C. Crumpton, F. Marx and R. Hunt. The meeting adjourned at 10:30.

Detroit Branch

Regular meeting Detroit Branch, October 2, 1925, with President Cunningham presiding. One applicant was refused, not qualified.

After reading President E. J. Musick's request for an increased membership, everyone considered themselves a committee of one and the secretary's supply of application blanks was gone. A new supply is on the way, boys. You are at liberty to use any old sheet of paper to write up likely candidates, and the secretary will do the rest.

A. E. Shepherd of the Educational Committee reported that the Cass Tech. School would start a class if twenty pupils signed up, but the members remember the treatment accorded them some years back and are not breaking any speed records to go.

Under the good of the order miscellaneous subjects were discussed. The fumes of chromium baths were dangerous for the eyes. Use goggles, they are safer and cheaper.

We understand our old friend Murphy is out peddling a nickel bath addition. If you know anything good or otherwise of it, let us know at once and stamps will be mailed you for your trouble.

In electro-etching, why is the etching more violent at the top of the solution (at the water line)? This created quite a discussion, but without any definite results, as for instance: Answer—On account of the nascent hydrogen and more acid being formed, but hydrogen is not

formed or evolved at the anode and oxygen is not readily formed with a soluble anode. We expect a more reasonable answer next time.

Their brains (?) racked a motion to adjourn was unanimously carried.

Pittsburgh Branch

We received the applications of two new members at our meeting last evening, one active and one associate.

Our attendance was of the average, and it seemed that with the new applications Pittsburgh Branch will be taking on new life, as some of those present stated they are going after some of the prizes being offered for this new membership drive, and hope to show that Pittsburgh can do something once they get going. Have nothing new to report at this time, but expect to be able to have something from now on, as business seems to be much better in this district, which ought to make our meetings more interesting.

Toronto Branch

Our September meeting, the first since July, was attended by about the usual number of wideawake platers. The opening of the Technical School class in plating practice received considerable attention and the prospects are good for a splendid program this year. Mr. J. A. Magill will be instructor again.

Mr. Thomas O'Keefe opened a discussion respecting the promotion of the social side of our society work, and a committee was appointed to originate and promote some plan which will aid in making our meetings so attractive that every resident member will attend regularly.

Question—Why does nickel silver stored in water tank tarnish quicker in summer than in winter when water is cold?

Answer—Action of chlorine used at filtering station believed to be more pronounced when water is warm.

Questions (1)—What is the residue from a sulphuric-nitric strip used for stripping silver from nickel-silver?

Questions (2)—What reaction takes place in same?

Answer (1)—Silver sulphate.

Answer (2)—Silver nitrate in solution which is precipitated as silver sulphate.

Philadelphia Branch

Regular monthly meeting of Philadelphia Branch was held October 2, with George Gehling in the chair.

Mr. H. K. Graham continued his talks on nickel solutions. Topic of the evening was the determination of the P. H.; also explained the use of indicators.

Banquet committee reported that the annual banquet will be held November 21, at Moseback's, and they are looking forward to a large attendance.

Philadelphia Branch's hat is in the ring to win the cup donated by

the Supreme President for the best membership record during the year. We have made a good start by receiving three applications at the October meeting, and are counting on every member to bring in at least one new member.

Bridgeport Branch

The regular meeting of the Bridgeport Branch was held on October 2. Past President Flaherty presided in the absence of President Belle.

The resignation of President George Belle, advising us that due to working conditions at his factory (overtime work many evenings) he finds it impossible to attend the monthly meetings, was accepted. William Flaherty was elected president for the remainder of the term.

The speakers committee announced that they hoped to secure Mr. George Hogaboom to address us at our special meeting October 16.

Chemical class will continue October 23.

The outing committee reported that the outing that was held on September 19 was a financial success, and letter of congratulation from out-of-town members and guests who were present, along with the opinion of our own members, indicated that it was also a huge success from a social standpoint.

Special at Newark

Newark Branch has completed arrangements for a dinner and illustrated lecture on November 6, 1925, at Achel Stetters, Broad street, Newark.

Mr. Stanlaus Skowronski from the Raratan Copper Company will be the speaker and his subject will be "Electrolytic Refining of Copper."

Mr. Sam Taylor, the librarian, is chairman of arrangements committee. All members will receive a return postal card, and we urge them to reply at once their intentions of attending or not. His address is 793 Parker street, Newark, N. J. Newark Branch also extends an invitation to neighboring branches to join with them on this occasion.

Newark Branch has been instrumental in bringing about the following announcement. They are to be congratulated:

"Free evening instruction in electroplating. Elementary course for assistants or those not possessing any knowledge of chemistry. Advanced Course for foremen platers and men who want more advanced instruction. Registration: Monday, September 28, and Tuesday, September 29, 7:30 to 9:30 P. M., Boys' Vocational School, Sussex avenue, at First Street, Newark, N. J. This course is open only to those employed in electroplating departments who desire to obtain a knowledge of the principles and methods for controlling electroplating solutions. Instruction is free, but a registration fee of one dollar is charged. The fee will be returned at the close of the course if attendance is satisfactory. A certificate of accomplishment will be issued to each pupil completing the course."

Cleveland Branch

On October 3, 1925, the Cleveland Branch met at the Hotel Winton

for their regular October business meeting, which was very interesting, and had a large attendance, with all officers present. We received the two applications. We had a round-table discussion on brass plating on malleable iron and spotting out. Adjournment was called for at 10 P. M.

Chicago Branch

Regular monthly meeting Chicago Branch, A. E. S., held October 10, 1925. Meeting called to order with President F. L. Greenwald presiding, and all officers present. There was a very good attendance.

President Greenwald appointed a special committee to act on the membership drive and requested all members to lend every effort possible to help in this cause.

Committees were also chosen for our coming banquet, which we wish to make one of the largest yet held.

Having no special subject for the evening the librarian read some very interesting papers on spotting out and their causes; also some notes on chromium plating, which will be our subject for a meeting in the near future.

QUESTION BOX, CHICAGO BRANCH

Question 1.—Can chromium be deposited on any metal?

Answer 1—Brass and steel were the metals successfully plated.

Question 2—How to prevent spotting out of gold-plated fixture parts made out of cast brass and white metal?

Answer 2—One member stated that by nickel plating and then gold plating overcame this spotting out.

Question 3—Whis is the more durable, a hot gold or cold gold deposit?

Answer 3—This depended on the weight of deposit and karat of gold used.

Question 4—Is sal ammoniac a good brightener for a warm zinc cyanide solution?

Answer 4—Sal ammoniac will brighten deposit, but same should not be used when using steel tank as chlorides attaches steel.

Question 5—How can spotting out of brass-plated cast iron be prevented?

Answer 5—Several answers were given, suggesting that casting be nickel plated before brass plating; also to heat castings after brass plating. It was also stated that over-pickled casting cause spotting out and should be properly washed before plating.

Dayton Branch

Our September meeting was held September 12 with a small attendance. Our meeting was called to order by our vice-president, Mr. Zemter. Minutes of the previous meeting were approved as read. As there was no other business the evening was then taken up in making arrangements for our annual banquet, Mr. Hohman and Mr. Bates being appointed a committee on arrangements, which was held on our regular meeting night, October 3, at the Y. W. C. A., with a large at-

tendance, and after the banquet the members, with their wives and sweethearts, attended a theatre, where a very enjoyable evening was spent.

All the members feel that Dayton district will go over the top with 100 per cent in the membership drive.

APPLICATIONS FOR MEMBERSHIP

Toronto Branch

Mr. Lyle Morrison, Active .....926 Oak St., Niagara Falls, Canada
Mr. Thos. W. Johnson, Active.....271 Spadina Ave., Toronto, Canada

Cleveland Branch

Charles H. Reinert .....c|o Firestone Steel Products Co., Akron, Ohio
S. L. Fercier .....1013 E. 148th St., Cleveland, Ohio

REINSTATEMENTS

Toronto Branch

Mr. David Ayres, Active .....Prescott, Ontario, Box 318, Canada.
Mr. S. Chas. Moore, Active .....1336 12th St., Detroit, Mich.

Pittsburgh Branch

Mr. Harry A. Spangler, Active .....6343 Broad St., Pittsburgh, Pa.
Mr. John E. Lohstoeter, Assoc. ....1312 Sheffield St., N. S., Pittsburg, Pa.

Newark Branch

George J. Wagner .....1198 Long Ave., Hillside, N. J.

ELECTED TO MEMBERSHIP

Cleveland Branch

Wm. H. Schultz .....1609 Eddington Rd., Cleveland Heights, Ohio

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TRANSFERED

Milwaukee Branch

C. J. Klein (what is your address?) .To Chicago Branch.

REINSTATED

Toronto Branch

David Ayers, Active .....Box 318, Prescott, Ontario
S. C. Moore .....1336-12th St., Detroit, Mich.

SUSPENDED

Indianapolis Branch

B. D. Aufderheide .....635 Ky. Ave., Indianapolis, Ind.
Wm. Cartheuser .....1446 N. Mount St., Indianapolis, Ind.
J. F. Vehling .....4217 College Ave., Indianapolis, Ind.
C. Howard .....1102 E. 8th St., Anderson, Ind.
C. H. Humphrien .....1123 N. McCann St., Kokomo, Ind.

BOSTON

Regular meetings are held first Friday of each month, at 8 p. m., at the American House, Boston. Secretary, A. W. Garrett, 89 Alexander St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary R. J. O'Connor, 1128 Noble Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, Robt. Meyers, 2210 Wilson Ave., Chicago, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. Secretary, H. S. Kneeland, 3924 Clybourne Ave., Cleveland, Ohio.

HARTFORD-CONN. VALLEY

Meets on the fourth Monday of each month at 747 Main St., Hartford, Conn. Secretary, Tennant Elwin, 1145 Boulevard, West Hartford, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Albert Bates, Box 34, Vandalia, Ohio.

DETROIT

Meets first Friday of each month at 478 Alexandrine West. Secretary, R. L. Shepard, 1388 Yorkshire Road, Fox Creek Sta., Detroit, Mich.

GRAND RAPIDS

Meets on the second Wednesday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, John Raven, 1139 Emerald Ave., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

MILWAUKEE

Meets second and fourth Thursdays of each month at Lipps Hall, 321 3d St. Secretary, Roy Hunt, 1314 Atkinson Ave., Milwaukee, Wis.

MONTREAL

Meets every Friday at 84 Craig St. West. Secretary, John H. Feelay, 411 Aylmer St., Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Hotel St. Francis, 22-24 E. Park St., Newark, N. J., at 8 p. m. Secretary, F. W. Matts, 55 Concord Ave., Hilton, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, J. E. Sterling, 468 Grand Ave., Long Island City, N. Y.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Saturday of each month at 8 p. m., at United States Bureau of Mines Bldg., Forbes St. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 184 Washington St., Room 308, Providence, R. I. Secretary, Robert Crook, 185 County St., Attleboro, Mass.

READING

Meets on the second Tuesday of each month. Secretary, William M. Fisher, 654 Gordon St., Reading Pa.

ROCHESTER

Meets every second and fourth Saturday of each month at the Powers Hotel. C. A. Reama, Secretary, 512 Lyell Ave., Rochester, N. Y.

ST. LOUIS

Meets first Tuesday of each month at Barr Branch Library, corner Jefferson and Lafayete Sts. Secretary, F. P. Menniges, 3205 A Arsenal St., St. Louis.

TOLEDA

Meets first Thursday of each month at Toledo University Science Building, Electro-Platers' Room, corner Cherry and Page Sts. Secretary, W. W. Weiker, 411 3d St., Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. Walter L. Barrows, 628 Dover Court Road, Toronto, Ontario, Canada.

WATERBURY

Meets every second and fourth Friday of each month. Secretary, Wm. F. Guilfoile, 14 Oakland Ave., Waterbury, Conn.